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The Effects of Price on Alcohol Use, Abuse, and Their Consequences

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Over the past two decades, a growing number of economists have examined the impact of alcoholic beverage prices on alcohol consumption and heavy drinking. Similarly, many studies have considered the impact of price on a wide range of problems caused by alcohol use and abuse, including nonfatal and fatal accidents caused by drinking and driving, liver cirrhosis and other alcohol-related diseases, violence and other crime linked to alcohol, decreased educational attainment, and more. Several of these studies have focused on high-risk populations, such as youth and young adults, including college students. This research, using a variety of different data and empirical approaches, generally has found that increases in the prices for alcoholic beverages lead to reductions in drinking, heavy drinking, and the consequences of alcohol use and abuse.

These findings confirm perhaps the most fundamental law of economics—that of the downward-sloping demand curve. This law states that as the price of a product rises, the quantity demanded of that product falls. Given this law, policies that raise the prices of alcoholic beverages can be effective in reducing the health, economic, and social consequences resulting from alcohol use and abuse.

This chapter begins with a brief review of the assortment of policies that can impact the prices of alcoholic beverages. The review is followed by a discussion of the large and growing economics literature examining the impact of price on alcohol use, heavy drinking, and the consequences of alcohol use and abuse, with a particular emphasis on studies focused on

youth and young adults.[1] Given the size and scope of the economic literature on alcohol use and its consequences, this review does not claim to be comprehensive, but instead highlights key studies and the general conclusions that emerge from these and other studies not described in detail.

Public Policies and Alcoholic Beverage Prices

Federal, state, and local governments have adopted a wide variety of public policies with the intent of reducing the consequences of alcohol use and abuse. Many of these policies impact the "full price" of alcoholic beverages. In the context of economic research on alcohol, "full price" includes not only the monetary prices of alcoholic beverages, but also many other "costs" associated with drinking and related behaviors. Two other costs most commonly included in this research are the time costs associated with obtaining alcoholic beverages and the expected legal costs associated with drinking and related outcomes. This review, however, will focus on policies that impact the monetary prices of alcoholic beverages.

Taxation

Of the policies directly influencing the prices of alcoholic beverages, excise taxation is the most widely employed. The popularity of alcoholic beverage taxation is largely due to the revenue-generating potential of these taxes, although public health arguments supporting increased beer, wine, and spirits taxation have been used more frequently in recent years. Most alcohol excise taxes are specific taxes applied based on the quantity or volume of a given alcoholic beverage.

Federal alcoholic beverage taxation. Federal excise taxes on alcohol date back to the late eighteenth century and have been raised over time, most often to generate new revenues during wartime.[2] Over the past half-century, however, federal excise taxes on alcoholic beverages have been increased infrequently, with the most recent increases aimed at reducing gov-

[1]This chapter draws heavily on several recent reviews, including Chaloupka, Grossman, and Saffer (1998, 2002), Cook and Moore (2000, 2002), and U.S. Department of Health and Human Services (DHHS) (2000).

[2]See the Bureau of Alcohol, Tobacco, and Firearms Web site (http://www.atf.treas.gov/alcohol/stats/historical.htm) for a detailed history of federal alcoholic beverage excise taxes and for examples of the increases in these taxes during the U.S. Civil War, both World Wars, and the Korean War.

TABLE 9-1 Federal Alcoholic Beverage Excise Taxes

Beverage Type	Tax as of 11/1/51	Current Tax	Inflation-Adjusted Value of 11/1/51 Tax
Distilled spirits	$10.50/proof gal.	$13.50/proof gal.	$71.87/proof gal.
Wine			
Not over 14%	$0.17/wine gal.	$1.07/wine gal.	$1.16/wine gal.
14-21%	$0.67/wine gal.	$1.57/wine gal.	$4.59/wine gal.
21-24%	$2.25/wine gal.	$3.15/wine gal.	$15.40/wine gal.
Beer	$9.00/barrel	$18.00/barrel	$61.60/barrel

NOTES: Current taxes were set January 1, 1991. Other wine taxes include taxes on champagne/sparkling wines and artificially carbonated wines. Inflation-adjusted values are based on the All Urban Consumers consumer price index series using the values of the index from November 1951 to August 2002.
SOURCE: Bureau of Alcohol, Tobacco, and Firearms (2002).

ernment budget deficits (see Table 9-1).[3] In addition, the rates applied to the alcohol contained in different beverages vary, with current federal taxes amounting to approximately 21 cents per ounce of pure alcohol in spirits, 10 cents per ounce of pure alcohol in beer, and 7 cents per ounce of pure alcohol in table wine (DHHS, 2000).

Because of the infrequent and modest increases in these taxes, their real (inflation-adjusted) value has declined substantially. The federal beer excise tax, for example, was set at $9 per 31-gallon barrel (16 cents per six-pack) on November 1, 1951, and maintained at that level until being doubled to $18 per barrel (32 cents per six-pack) on January 1, 1991. In real terms, however, the current federal beer excise tax is well below its 1951 value of $61.60 (August 2002 dollars). The same is true for spirits taxes, which were set at $10.50 per proof gallon ($1.68 per fifth of 80-proof alcohol) in 1951, raised to $12.50 per proof gallon in 1985, and then raised to their current level of $13.50 per proof gallon ($2.16 per fifth of 80-proof alcohol) in 1991. Again, the current tax is well below the $71.87 (August 2002 dollars) that would be needed to reach the real value of the distilled spirits tax in effect in late 1951. Federal wine taxes are more varied, with different taxes applied based on alcohol content. These taxes currently range from $1.07 per wine gallon for wine with alcohol content not more than 14 percent to $3.40 per wine gallon for champagne and sparkling wines. As with the other federal alcoholic beverage excise taxes, the inflation-adjusted values

[3]For example, federal beer and wine excise taxes were last increased in 1991 (the first increases in both since 1951) as part of the Omnibus Budget Reconciliation Act of 1990; this legislation also increased the distilled spirits tax for only the second time since 1951, with the previous increase in 1985 also the result of deficit reduction legislation.

of these taxes have fallen considerably since 1951, with the exception of the more modest decline in the real-value tax on wines with not more than 14 percent alcohol content.

State alcoholic beverage taxation. In general, the same patterns emerge at the state level, with state distilled spirits taxes typically at the highest rate per drink, taxes increasing infrequently and modestly over time, and, as a result, real values of state alcoholic beverage excise taxes falling significantly over time. State alcoholic beverage excise taxes are more mixed, with some states applying specific taxes and others using ad valorem taxes (taxes expressed as a percentage of price, rather than based on quantity or volume). As of January 1, 2000, the average state excise tax applied to a typical serving of alcohol was 4.13 cents for distilled spirits (1.5 ounces), 2.82 cents for wine (5 ounces), and 2.51 cents for beer (12 ounces) (Alcohol Epidemiology Program [AEP], 2000). Beer taxes (the easiest to compare across states and over time because nearly all states apply a specific excise tax to beer) have been eroded sharply by inflation, with the real value of the average state beer tax in 2000 about one-third of its level in 1968 (AEP, 2000). Some states have increased these taxes periodically, but only six states increased their beer taxes enough to keep up with or outpace inflation since 1968, while 35 states saw the real value of their beer tax fall by more than 50 percent since 1968 (AEP, 2000).

Excise taxes and price. Excise taxes are expected to be an important component of alcoholic beverage prices at the retail level. However, little is known either about the extent to which changes in alcoholic beverage excise taxes are passed along to drinkers in the form of higher prices or about the market conditions that affect this passthrough.[4] Cook (1981) provides some early evidence that suggested that distilled spirits taxes were more than passed on in the form of higher distilled spirits prices in license states. This finding was confirmed by Young and Bielinska-Kwapisz (2002) in their more recent econometric analysis of the relationship between alcohol taxes and beverage prices. They concluded, for example, that the doubling of the federal beer tax in 1991 (a $9-per-barrel increase) led to a much larger ($15 to $17) and relatively rapid increase in retail beer prices.

Given this limited empirical evidence, it is almost certain that the stability of the nominal federal and state excise taxes on alcoholic beverages has played a major role in the substantial declines in the inflation-adjusted

[4]In contrast, several studies have examined the extent to which federal and state cigarette excise taxes are passed on in the form of higher cigarette prices, with most concluding that increases in cigarette taxes result in at least comparable increases in cigarette prices (Chaloupka, Hu, Warner, Jacobs, and Yurekli, 2000).

prices of alcoholic beverages over time. For example, the average price of alcoholic beverages after adjusting for inflation fell by nearly 32 percent from 1953 to 2001. Given the research I will discuss, allowing the real value of alcoholic beverage excise taxes and, consequently, prices, to decline over time will result in increased drinking and its consequences.

Policies Affecting Distribution, Competition, and Price

In addition to taxation, a number of other alcohol-related policies directly or indirectly influence the prices of alcoholic beverages. Since the repeal of Prohibition, a three-tier system for the distribution of alcoholic beverages has evolved. This system includes producers/suppliers, wholesalers/distributors, and retailers. A complex set of policies affects how alcohol is distributed, priced, and promoted at each level.

Direct state control. Over time, states have taken differing degrees of control over various aspects of this distribution system, with some states monopolizing the retail sale (for off-premise consumption) and wholesale sale (including sales to outlets licensed to sell for on-premise consumption) of some alcoholic beverages (most often distilled spirits and, in some states, wine), while others employ a license system. Currently, 18 states retain some monopoly power, with 3 states exerting control over wholesale and retail sales of table wine, spirits, and other moderate- to high-alcohol content beverages (New Hampshire, Pennsylvania, and Utah), 8 states controlling wholesale and retail sales of high-alcohol content beverages only (Idaho, Michigan, Montana, North Carolina, Ohio, Oregon, Vermont, and Washington), and the other 7 states exerting control in wholesale markets only (Alabama, Iowa, Maine, Mississippi, Virginia, West Virginia, and Wyoming) (AEP, 2000). Changes in the nature of state monopoly control over the alcohol distribution system have been rare and tend to apply to minor aspects of the system.

States with monopoly control over some parts of the alcohol distribution system directly set the prices for the alcoholic beverages they control at the wholesale and, where applicable, retail level. Economic theory predicts that prices will be higher in markets that are monopolized or highly concentrated than they will be in more competitive markets. However, there is little empirical research on the impact of the structure of alcoholic beverage markets on the prices of alcoholic beverages, with the existing research producing mixed findings. Nelson (1990), for example, concluded that alcoholic beverage prices in monopoly states are at best slightly higher than in license states, while MacDonald (1986) found that increased availability resulting from changes in the control system led to lower prices in some, but not all, markets.

Other State Policies

Likewise, states have adopted a number of other policies that aim to directly or indirectly influence the prices of alcoholic beverages, with policies often varying in their applicability to different beverage types and multiple policies being used together. For example, in addition to direct state involvement in the alcohol distribution system, states regulate competition in alcoholic beverage markets in a variety of other ways, ranging from limiting availability through the licensing of retailers and wholesalers to the adoption of exclusive territory policies that grant monopoly power over a particular geographic area to a specific distributor. As with the impact of taxation on alcoholic beverage pricing, relatively few studies have examined the impact of these policies on prices, with those that have focused on the impact of exclusive territories policies for beer distribution (Jordan and Jaffee, 1987; Culbertson, 1989; Culbertson and Bradford, 1991; Sass and Saurman, 1993, 1996). These studies did find that exclusive territories policies result in higher beer prices.

Similarly, a number of states have regulations that require wholesalers to post or file prices for alcoholic beverages, with the stated or implicit intent of at least some of these policies to reduce price competition in the alcoholic beverage markets. Others restrict wholesalers' ability to price discriminate by granting volume discounts that would result in lower per-unit prices for retailers that buy in large quantities, which could result in lower retail prices in these outlets. Still others restrict wholesalers' and retailers' capacity to engage in price-related promotions and other marketing efforts that again could lead to lower prices for alcoholic beverages.

In addition, state and local governments have adopted policies limiting price-related promotions in on-premise establishments, including, for example, restrictions on "happy hour" specials or on the sale of beer by the pitcher. Others have similarly banned the free sampling of alcoholic beverages.

Other state policies that can indirectly influence the price of alcoholic beverages relate to policies that affect the distribution of alcoholic beverages. These policies include "at rest" laws, "primary source" laws, "direct shipping" laws, and "reciprocity" laws. At rest laws require that alcoholic beverages actually be delivered to (come to rest with) wholesalers before being passed on to retailers. The intent of these policies is to keep retailers from negotiating favorable prices directly with suppliers. Primary source laws limit the sources of alcoholic beverages to wholesalers to only those suppliers licensed to sell within the state, potentially restricting competition at the supplier level and, consequently, increasing prices at the wholesale and retail levels. Direct shipping laws are similar in that they prevent consumers from buying directly from suppliers or wholesalers at prices that are

likely lower than would be available when buying from retailers. Some states have somewhat relaxed versions of these laws that allow direct shipments to consumers in their state (state A) if the shipments originate in a state (state B) that allows such shipments from their state (state A); these provisions are known as reciprocity laws.

The direct shipment and reciprocity laws have been the subject of much debate in recent years as Internet use has increased. Much of this debate has focused on direct sales of wine from small wineries and/or retailers to consumers via a Web site. Some states allow these direct sales with no restrictions, others allow them only from sellers in states that have reciprocity agreements, others allow them only to consumers who have obtained a permit, still others allow them but limit the quantities that can be purchased, and others prohibit them completely.

In general, resulting in part from legal challenges initiated by alcoholic beverage wholesalers or retailers, state laws and regulations limiting competition in the alcoholic beverage markets have been relaxed over time. Some states, for example, have eliminated their price posting policies and/or restrictions on price discrimination after legal challenges from wholesalers, while others have successfully defended such challenges. Numerous challenges have been brought against state policies affecting direct shipments, and many of these have yet to be resolved. Those challenging the laws typically argue that they unduly restrict interstate competition and are, as a result, in conflict with the Constitution's interstate commerce clause that prohibits discrimination against out-of-state businesses. Defenders argue that these policies are allowed by the 21st Amendment, which repealed prohibition and gave states the power to regulate the distribution of alcoholic beverages.

Finally, some states have limited the ability of retailers to advertise prices for alcoholic beverages, arguing that price advertising would result in greater price competition in the alcoholic beverage markets, lower alcoholic beverage prices, and increased drinking and its consequences.

Overall, challenges to many of these laws have been successful (with rare exceptions) and state control over the distribution, pricing, and advertising/promotion of alcoholic beverages has been lessened. The increases in competition that result from these changes have almost certainly contributed to the reductions in the real prices of alcoholic beverages that have been observed over the past few decades. However, empirical evidence on the impact of changes in these policies on alcoholic beverage prices, drinking, and its consequences is almost nonexistent. Clearly, more research is needed to fully understand the impact of the complex and varied policies that affect alcoholic beverage distribution, marketing, and pricing on the retail prices of these beverages.

Alcoholic Beverage Prices and Consumption

One of the most fundamental laws of economics is that of the downward-sloping demand curve, which states that as the price of a product rises, the quantity consumed of that product falls. Some have suggested that this law may not apply to the demands for addictive products, including alcohol. Numerous studies over the past two decades have addressed this question, generally concluding that increases in alcoholic beverage prices do result in reductions in drinking. These studies have used a variety of econometric and other statistical methods applied to different types of data. Many have examined the impact of price on overall alcohol demand, using aggregated or beverage-specific alcoholic beverage sales data at the national or state level. Others have estimated the impact of price on an individual's decision to drink, frequency of alcohol consumption, number of drinks consumed, and heavy drinking behaviors, using data taken from a variety of surveys.

Some studies use measures of actual alcoholic beverage prices taken from various data sources, while others employ measures of alcoholic beverage taxes (most frequently beer taxes) as a proxy for alcoholic beverage prices. These studies attempt to control for a variety of other factors that may also impact alcohol demand, including age, income, race/ethnicity, education, and more. Similarly, many of these studies also have attempted to control for other alcohol-related policies that may be correlated with alcoholic beverage prices and taxes, including measures of alcohol availability, laws related to drinking and driving, and others.

Overall Alcohol Demand

Economists use the price elasticity of demand to describe the sensitivity of alcohol consumption to a change in the prices of alcoholic beverages. The price elasticity of demand is defined as the percentage change in consumption resulting from a 1 percent increase in price, all else constant. In their 1993 review of the studies based on aggregate data from the United States (either national or state level) and other countries, Leung and Phelps concluded that the price elasticities of demand for beer, wine, and distilled spirits are –0.3, –1.0, and –1.5, respectively, implying that beer consumption is relatively insensitive to changes in the price of beer, while increases in wine and spirits prices would lead to proportional or greater reductions in the overall consumption of wine and spirits. Analyses using individual-level data suggest that the impact of price on alcohol consumption may be even greater than that obtained in studies using aggregated data. These differences may be partly due to the differential response to price of different population subgroups (such as youth and young adults) that are often the focus of studies using individual-level data.

More recent studies of alcohol demand (Nelson, 1997, 1999; Kenkel, 1993, 1996; Manning, Blumber, and Moulton, 1995) confirm that higher alcoholic beverage prices lead to reductions in alcohol consumption. However, as with the earlier studies, the range of estimates of the price elasticity of demand produced by these studies is relatively wide. Nelson (1997), for example, estimated that the overall price elasticity of alcohol demand was –0.52, with beverage-specific elasticities of –0.16 for beer, –0.58 for wine, and –0.39 for distilled spirits.

In addition, several studies have attempted to estimate the cross-price elasticities of alcoholic beverages, which provide an indication of the substitutability of one beverage for another. However, this has been quite difficult given the relatively high correlation between alcoholic beverage prices and taxes, which makes it difficult to sort out the impact of a change in the price of one beverage from changes in the prices of others. In general, these studies provide limited evidence of substitutability, with cross-price elasticities that are relatively small or statistically insignificant (Edwards et al., 1994).

Price and Teen Drinking

A relatively large share of the economic research on the effects of alcohol prices on drinking has focused on drinking among youth and young adults. This is due to the relatively high levels of drinking, particularly heavy or binge drinking, in these age groups, as well as to the relatively high incidence of alcohol-related problems in this population (DHHS, 2000). For example, fatal motor vehicle accidents are the leading cause of death for persons under age 35, and alcohol is involved in more than half of these fatal crashes. Similarly, drinking behavior tends to be initiated in adolescence, with problem drinking increasing through the early 20s before beginning to fall. Data from the Monitoring the Future surveys, for example, indicate that more than half of all eighth graders nationally have drunk alcohol at least once, rising to about 80 percent among high school seniors (Johnston, O'Malley, and Bachman, 2002). More importantly, about one-quarter of eighth graders indicate having been drunk at least once, while nearly two-thirds of seniors do so. In addition to the short-term consequences of heavy drinking during these ages, there can also be substantial adverse effects in the long run as a result of the negative impact of drinking on educational attainment and other factors.

Grossman and his colleagues were the first to study the impact of alcoholic beverage prices on youth alcohol use, using data from the first and second waves of the National Health and Nutrition Examination Surveys conducted in the 1970s (Grossman, Coate, and Arluck, 1987; Coate and Grossman, 1988). Both studies found that increases in beer prices and

higher minimum legal drinking ages would lead to significant reductions in youth beer consumption. Of particular interest was their examination of the differential impact of prices on different types of youth drinkers, categorized based on their frequency or level of consumption. They defined infrequent drinkers as those consuming less than once per week, fairly frequent drinkers as those consuming one to three times per week, and frequent drinkers as those consuming four or more times per week. Grossman and colleagues found that higher beer prices reduced consumption in each of the three subgroups, but that the fractions of youth who consumed fairly frequently and frequently fell by more in both absolute and percentage terms than did the fraction of infrequent drinkers when prices rose. Similarly, they defined light drinkers as those who consumed one or two cans of beer on a typical drinking occasion, fairly heavy drinkers as those consuming three to five cans, and heavy drinkers as those consuming six or more beers on a typical drinking occasion. Again, they found that the increases in price would have a greater impact (in both absolute and percentage terms) on the fractions of heavy and fairly heavy drinkers than they did on the fraction of light drinkers.

Laixuthai and Chaloupka (1993) addressed this issue using more recent data from the 1982 and 1989 Monitoring the Future surveys of high school seniors. They defined three alternative measures of alcohol consumption reflecting frequency of drinking in the past year, frequency of drinking in the past 30 days, and participation in binge drinking (6 or more drinks on a single occasion) during the past 2 weeks. The data from the two years were analyzed separately in order to observe changes in the price sensitivity of drinking over time. Laixuthai and Chaloupka's findings were similar to those of Grossman and his colleagues in that higher beer taxes were associated with reductions in the frequency of drinking and the probability of heavy drinking among youth. Similarly, they found that higher taxes would lead to larger reductions in the fractions of frequent and fairly frequent drinkers than in the fraction of infrequent drinkers. Perhaps most interestingly, they found that the impact of price on youth drinking was smaller in 1989 than it was in 1982, attributing the change in price sensitivity over time to the increases in drinking ages that occurred during the 1980s. Laixuthai and Chaloupka contended that the increases in state drinking ages reduced the share of monetary price in the full price of alcohol for youth, which includes the legal and other costs associated with underage drinking. Thus, when drinking ages are relatively low, a given increase in the monetary price of alcoholic beverages has a larger impact on the full price of alcohol for youth than does the same increase when drinking ages are higher.

More recently, Cook and Moore (2001) used data from the National Longitudinal Survey of Youth (NLSY) to examine the impact of alcoholic

beverage prices and drinking ages on youth drinking. The NLSY first surveyed youth ages 14 to 21 in 1979, then reinterviewed them periodically over time, collecting information on alcohol consumption in several waves. Two measures of drinking were employed—one reflecting any alcohol consumption in the 30 days prior to the survey and a second indicating consumption of 6 or more drinks on a single occasion. Cook and Moore found that higher beer taxes and drinking ages were associated with reductions in both measures of drinking. Interestingly, they also found that the alcohol-related environment earlier in one's youth (based on the drinking age and tax a youth faced at age 14) has a significant impact on later drinking behavior, supporting the notion of habit formation or addiction.

In contrast, Dee (1999) used data from the 1977 through 1992 Monitoring the Future surveys of high school seniors to estimate the impact of beer taxes and drinking ages on the prevalence of youth drinking, concluding that higher beer taxes would not reduce youth drinking. Three levels of drinking were examined: any drinking in the past month; ten or more drinks in the past month; and five or more drinks on a single occasion at least once in the past two weeks, using state-level measures constructed from the survey data. In addition to a limited set of covariates, Dee included state-level fixed effects in his models to capture the unobserved, state-specific factors that might affect alcohol consumption. In contrast to the earlier research on price and youth drinking, including the studies described, Dee found that beer taxes do not significantly affect any of his measures of teen drinking when the state fixed effects are included.

Dee's findings, however, should be treated with caution before rejecting the findings from the earlier research that concluded that higher taxes and prices would lead to significant reductions in youth drinking, particularly heavy and frequent drinking. Although there is a potential omitted variables bias in the earlier studies that fails to account for the unobserved state sentiment toward drinking that may be reflected in state alcoholic beverage excise taxes and drinking ages, it is not clear in which direction this bias goes. For example, states with strong antidrinking sentiment where consumption is relatively low may enact higher taxes and stronger alcohol control policies, which could lead to an overestimate of the impact of price on drinking. On the other hand, states with greater prodrinking sentiment and higher alcohol consumption may view alcohol taxation as an attractive source of revenues, adopting higher taxes and, as a result, leading to an underestimate of the impact of price on drinking. This is further complicated by the fact that alcoholic beverage taxes, as discussed, have been relatively stable over time, making them highly correlated with a set of state fixed effects. One consequence of this high correlation when estimating demand models that include state fixed effects is that it is difficult to separate the independent effects of alcoholic beverage prices or taxes from the

state indicator variables, leading to insignificant estimates for the correlated variables.

In addition, Dee's measures of drinking are problematic given that they are state-level measures constructed from the Monitoring the Future survey data. The Monitoring the Future survey is a multistage, school-based survey that is designed to be nationally representative (Johnston, O'Malley, and Bachman, 2002). The sample of schools, however, is not designed to produce state-representative estimates. In any given year, between 120 and 145 schools participate in the twelfth-grade survey, with some states infrequently represented and others represented by one or two schools. Thus, there is substantial variation for each state over time in the measures of drinking Dee used because of changes in the sample of schools representing each state. Much of this variation is unlikely to reflect real change in drinking among teens in the state, but is instead the result of changes in the socioeconomic and demographic characteristics of the students at the schools that participate in the survey.

Finally, as noted, a variety of other policies, in addition to the tax, can affect the prices of alcoholic beverages. Failing to account for these, particularly during a time when these policies are changing in many states, can lead to measurement errors in models that use taxes as a proxy for price, producing biases that are exacerbated when fixed effects are included.

To summarize, the majority of studies on price and youth drinking conclude that higher alcoholic beverage prices significantly reduce the probability, frequency, and level of drinking among youth. Given the limitations of these studies, additional research would be useful in clarifying these relationships.

Price and Young Adult Drinking

Several recent studies have examined the impact of price on drinking among young adults. Grossman, Chaloupka, and Sirtalan (1998), for example, explored the impact of price on young adult drinking in an econometric application of Becker and Murphy's (1988) economic model of addictive behavior. The key features of the Becker and Murphy model include (1) the idea that current consumption of an addictive substance (such as alcohol) will depend on past consumption, so that current consumption will be greater as past consumption is greater, and (2) the assumption that addicts are "farsighted" in that they will consider, at least to some extent, the future consequences of their current consumption decisions. Together, these assumptions have several implications concerning the impact of price on addictive consumption, including a greater long-run response to permanent price changes as addicted consumers gradually adjust to the new price,

and reductions in current consumption of an addictive product in response to anticipated changes in future prices and other costs.

Grossman and colleagues used the longitudinal data from the panels formed by the 1976 through 1985 baseline Monitoring the Future surveys of high school seniors and their follow up surveys through 1989. These data produced a sample ranging in age from 17 through 29, the ages during which alcohol dependence and abuse are at their peak and for which an approach accounting for the addictive aspects of alcohol consumption is likely to be most relevant. In addition to estimating models that account for addiction, the authors also estimated more traditional models that ignored the addictive aspects of alcohol consumption. Estimates from the addictive models provided strong support for the hypothesis that alcohol consumption is an addictive behavior for this age group in the sense that strong interdependency exists between past, current, and future alcohol consumption. Regardless of the approach, the authors found consistent evidence that higher alcoholic beverage prices led to significant reductions in alcohol consumption among young adults. Their estimated price elasticity of demand from models that did not account for addiction was –0.29. When accounting for the potentially addictive nature of alcohol consumption, however, they estimated an average long-run price elasticity of demand of –0.65, which, as predicted by the theory, was approximately 60 percent higher than the estimated short-run elasticity (which was higher than the estimates obtained from the models that ignored addiction).

Many recent studies of the impact of price on young adult drinking have focused on the effects on college students, a particularly high-risk group. Chaloupka and Wechsler (1996) conducted the first study for this population, using data from the 1993 Harvard College Alcohol Survey, a nationally representative survey of students at United States four-year colleges and universities. In addition to including measures of beer taxes and prices in their demand equations, the researchers also included a measure of alcohol availability and an index of state drinking and driving-related legislation. Finally, given differences in drinking patterns by age and gender, Chaloupka and Wechsler estimated separate demand equations for underage and older students and for males and females. In general, they found that prices did not have a significant impact on drinking among male college students or on older female students, while having a small but statistically significant effect on underage female students. The authors suggested that this was partly due to substantial measurement errors in their measure of alcoholic beverage prices taken from a retail price survey conducted by the American Chamber of Commerce Researchers Association, given the widespread promotion of alcohol on and around college campuses and the ready availability of alcohol at fraternity and other parties.

To address this issue more fully, Wechsler and colleagues added price-related questions to subsequent waves of the Harvard College Alcohol Survey. In response to these questions, students provided information on the average price they paid for a drink and on their participation in so-called "fixed-price" events where a flat price was paid for admission, with no additional charge per drink consumed. In addition, information on state and local price-related alcohol policies has been collected for the location of each campus, including information on policies limiting happy hour promotions and the sale of beer by the pitcher. Several recent studies have employed these data as an alternative to the tax and price data used in the initial Chaloupka and Wechsler study on price and college student drinking. Czart (2001), in her Ph.D. dissertation, for example, used the self-reported price information from the 1997 and 1999 waves of the Harvard College Alcohol Survey to examine the impact of prices on drinking by college students. She found generally consistent evidence that higher average alcohol prices reduced the likelihood, frequency, and prevalence of drinking among college students. Similarly, Williams, Chaloupka, and Wechsler (2002) used the self-reported price and drinking information taken from the 1997 and 1999 surveys to examine the impact of price and other factors on the transition from no drinking to moderate drinking and from moderate drinking to heavy or binge drinking. They found that students who faced a higher price for alcohol were less likely to make the transitions from abstainer to moderate drinker and from moderate drinker to heavy drinker, with the impact of price similar across the two thresholds. Similarly, they found that the greater availability of fixed-price events increased the probability of crossing both thresholds, consistent with the hypothesis that these events significantly reduced the per-drink cost.

Alcoholic Beverage Prices and the Consequences of Alcohol Use and Abuse

Economists have studied the impact of alcoholic beverage taxes and prices on numerous outcomes associated with alcohol use and abuse, including nonfatal and fatal traffic crashes caused by drinking and driving, self-reported drinking and driving behavior, other accidents, liver cirrhosis and other alcohol-related mortality, violence and other crime, suicide, risky sexual behavior, and decreased educational attainment. These studies are based on a conceptual framework in which higher alcohol taxes and prices lead to reduced problem drinking, resulting in reductions in the observed consequences of drinking. As with the demand studies already described, many other factors are included in the equations estimated in order to control for other potential determinants of the outcome(s) being examined.

Alcohol Prices and Drinking and Driving

Economists have conducted numerous econometric analyses of the impact of alcohol taxes and prices on drinking and driving. Most of these studies have used state-level information on fatal motor vehicle accidents taken from the Fatal Accident Reporting System as a proxy for drinking and driving, given the high degree of alcohol involvement in these accidents. For example, the National Highway Traffic Safety Administration (NHTSA) estimates that over 40 percent of all fatal traffic accidents involved alcohol (NHTSA, 2003). Several studies have used a subset of these accidents more likely to be alcohol involved, based on the time of day or number of vehicles involved. For example, NHTSA estimates that the rate of alcohol involvement is over three times higher in nighttime fatal accidents than in those during the day (NHTSA, 2003). Similarly, several have focused on the role of the individual killed in the accident (e.g., driver, passenger), and others have used information on the blood alcohol content of dead drivers to construct alcohol-involved measures. Other studies have used more disaggregated information (such as county-level data for a given state), and still others have used information on self-reported involvement in nonfatal accidents (including self-reports of those after consuming alcohol) and on self-reported drinking and driving behavior. Finally, many of these studies include estimates for high-risk subpopulations, particularly for youth and young adults.

Nearly every study that has considered the impact of alcoholic beverage prices on drinking and driving concludes that higher prices lead to significant reductions in drinking and driving. Saffer and Grossman (1987a, 1987b), for example, were the first to consider the impact of beer taxes on state-level motor vehicle accident fatality rates, using data from all states from 1975 through 1981 and controlling for other factors expected to impact the probability of fatal crashes, including drinking ages. They focused on youth and young adults, separately estimating the impact of taxes on 15- to 17-year-olds, 18- to 20-year-olds, and 21- to 24-olds. Both studies concluded that increases in beer taxes would significantly reduce youth motor vehicle accident fatality rates, a disproportionate number of which are the result of drinking and driving. Chaloupka, Saffer, and Grossman (1993) updated and expanded this research using similar data from 1982 through 1988, but also including adult fatality rates as well as several alternative fatality rates defined based on likelihood of alcohol involvement. In addition, they controlled for a wide range of state policies related to drinking and driving. Chaloupka and colleagues concluded that significant increases in alcoholic beverage excise taxes are among the most effective policies for reducing drinking and driving in all segments of the population, with the largest reductions occurring among teens and young adults.

More recently, Ruhm (1996), using data from the same period, extended this analysis by including state fixed effects in his models. In contrast to the Dee study on youth drinking discussed earlier, the inclusion of state fixed effects in the motor vehicle accident fatality equations did not change the findings, with Ruhm concluding that higher beer taxes would lead to significant reductions in fatal traffic crashes. In general, the estimates from econometric analyses of alcoholic beverage taxes or prices and fatal traffic crashes imply that a 10 percent increase in price would reduce overall traffic crashes by 5 to 10 percent, with even larger reductions—7 to 17 percent—for youth.

These estimates are consistent with the findings from studies using survey data on self-reported drinking and driving and on involvement in nonfatal traffic crashes. Kenkel (1993), for example, using data from the 1985 National Health Interview Survey, estimated that a 10 percent increase in price would reduce the probability of drinking and driving by 7.4 percent among males and 8.1 percent among females, with even larger reductions—12.6 percent and 21.1 percent—among young males and females, respectively. Chaloupka and Laixuthai (1997), using data taken from the 1982 and 1989 Monitoring the Future surveys, concluded that higher beer taxes would significantly reduce the probability of nonfatal traffic accidents among youth.

A few recent studies have questioned the general conclusion drawn from the relatively large economic literature on the impact of alcohol beverage prices or taxes on drinking and driving. Dee (1999) and Dee and Evans (2001) used various state-level motor vehicle accident fatality rates for 18- to 20-year-olds reflecting different levels of alcohol involvement for the periods from 1977 through 1992 and 1997, respectively. Both studies found significant negative effects of beer taxes on the various fatality rates employed, but the authors rejected these findings because the estimates of the effects of the beer tax were similar across the different fatality rates, in contrast to their hypothesis that the impact of taxes should increase as the degree of alcohol involvement increased (as found by Chaloupka et al., 1993). Mast, Benson, and Rasmussen (1999) used data for all ages in their analysis of motor vehicle accident fatality rates for 1984 through 1992. They found insignificant effects of beer taxes in some of their fixed effects models for the overall fatality rates, but negative and significant effects of beer taxes in models using nighttime single-vehicle accident fatality rates (where alcohol involvement is much greater). However, they put little weight on these findings because of changes in the magnitude of the estimates when different variables are included in the models.

To summarize, the majority of studies that have examined the impact of alcoholic beverage taxes or prices on drinking and driving behavior

conclude that increases in taxes and prices would lead to significant reductions in the likelihood of drinking and driving and in the nonfatal and fatal accidents that result. Further research would be useful in addressing the inconsistencies that have been raised between a few recent studies and the large body of existing evidence.

Alcohol Prices, Liver Cirrhosis, and Other Alcohol-Related Mortality

Several studies have examined the impact of alcohol taxes and prices on liver cirrhosis mortality rates, an adverse health outcome caused by long-term, heavy alcohol consumption. The earliest of these studies was by Cook and Tauchen (1982), who used state-level cirrhosis mortality rates for license states over the period from 1962 through 1977 to examine the impact of distilled spirits taxes. They concluded that significant tax increases would lead to large reductions in cirrhosis deaths, estimating that a $1 increase in the distilled spirits tax would reduce the cirrhosis death rate between 5.4 to 10.8 percent. This finding was confirmed by Grossman (1993) in his application of Becker and Murphy's economic model of addiction to heavy alcohol consumption, as reflected by the liver cirrhosis mortality rate. Using data from all states for 1961 through 1984, Grossman estimated that a 10 percent increase in the price of alcoholic beverages would reduce the cirrhosis death rate by 8.3 to 12.8 percent in the long run.

In contrast, Sloan, Reilly, and Schenzler (1994) found little impact of alcoholic beverage prices on deaths for which alcohol is a primary cause, including liver cirrhosis deaths, using state-level data from 1982 through 1988. However, they did find that higher alcoholic beverage prices led to significant reductions in a number of other alcohol-related death rates, including suicides, diseases for which alcohol is a contributing factor (including various cancers), and other accidental deaths (including drowning, accidental falls, fires, and others). This latter finding is confirmed by Ohsfeldt and Morrisey's (1997) examination of the impact of beer taxes on nonfatal workplace injuries. They used state-level data for 1975 through 1985, concluding that higher beer taxes would lead to significant reductions in workplace injuries. For example, they estimated that a 25-cent increase in the beer tax in 1992 would have reduced work days lost from nonfatal workplace injuries by 4.6 million, lowering the costs of lost productivity due to alcohol by $491 million.

Similarly, Markowitz, Chatterji, Kaestner, and Dave (2002) confirmed the finding that higher alcohol prices reduce suicidal behavior. Using data from the 1991 Core Institute's Alcohol and Drug Surveys of College Students, they examined the impact of beer prices and other factors on various measures of suicidal thoughts and actions among college students. The

researchers concluded that the likelihood of both suicidal thoughts and actions is lower among students on campuses in states where the beer prices are higher.

Chesson, Harrison, and Kasser (2000) used state-level data for all states over the period from 1981 through 1995 in their examination of the impact of alcoholic beverage taxes on risky sexual behavior, as reflected by sexually transmitted disease rates. Based on estimates from models including state and year fixed effects, they concluded that increases in beer and spirits taxes result in significant reductions in gonorrhea and syphilis rates. For example, they predicted that a $1 increase in the distilled spirits tax would reduce gonorrhea rates by 2.1 percent, while a 20-cent increase in the tax on a six-pack of beer would reduce gonorrhea rates by 8.9 percent, with similar, and in some cases larger, effects on syphilis rates.

Again, the general conclusion that can be drawn from the studies examining the impact of alcoholic beverage taxes and prices on various health outcomes related to alcohol is that increases in taxes and prices would lead to significant reductions in the health consequences of alcohol use and abuse.

Alcohol Prices, Violence, and Other Crime

Over the past decade, several studies have considered the impact of alcoholic beverage taxes and prices on violence and other crime. In the first of these studies, Cook and Moore (1993b) used state-level data on crime rates taken from the Uniform Crime Reports for the years from 1979 through 1987 to look at the impact of beer excise taxes on various violent crimes, including murder, rape, assault, and robbery. In relatively parsimonious specifications that included only state and year fixed effects in addition to the tax, they found that higher beer taxes would reduce some violent crime rates (rape and robbery), but have little impact on others (homicides and assaults). Sloan and his colleagues (1994) reached a somewhat different conclusion in their analysis of comparable data on homicides taken from the Vital Statistics, where they found that higher alcoholic beverage prices and reduced alcohol availability would reduce homicide deaths.

A series of recent studies by Markowitz and Grossman has contributed significantly to this literature. In their 1998 analysis, for example, Markowitz and Grossman used data from the 1976 National Family Violence survey to examine the impact of beer taxes and other alcohol control policies, as well as illegal drug prices and related policies, on child abuse. They concluded that an increase in beer taxes would lead to significant reductions in child abuse. They predicted that a 10 percent increase in the beer excise tax would reduce the probability of any child abuse by 1.2 percent,

while reducing the probability of severe child abuse by 2.1 percent. Using data on the number of children who are victims of child abuse, the investigators estimated that a 10 percent beer tax increase would have reduced the number of children who were victims of severe child abuse by 132,500. In a subsequent analysis, Markowitz and Grossman (2000) extended their research on the impact of alcohol on child abuse by adding the 1985 National Family Violence survey and considering the impact on abuse by men and women separately in models that also included state fixed effects. Based on their gender-specific analyses, the investigators concluded that increases in the beer tax are effective in reducing the probability that a woman commits child abuse, but do not significantly affect the probability of child abuse by men.

Using the longitudinal data from the 1985 National Family Violence survey and its 1986 and 1987 follow ups, Markowitz (2000) looked at the impact of alcohol prices and other policies on spousal abuse. In models that included individual specific fixed effects, she found that higher alcoholic beverage prices would lead to significant reductions in the probability of severe violence by husbands against their wives. Based on an average of estimates from alternative specifications, Markowitz predicted that a 1 percent increase in the price of pure alcohol would reduce the probability that a woman would be a victim of severe spousal abuse by 1 to 9.7 percent.

More recently, Grossman and Markowitz (2001) examined the impact of alcoholic beverage prices on violence and other delinquent behavior among college students, using data from the 1989, 1990, and 1991 Core Alcohol and Drug Surveys of College Students. They concluded that increases in beer prices would lead to significant reductions in each of the outcomes they considered, estimating that a 10 percent increase in beer prices would reduce the overall number of students involved in some sort of violent behavior by about 4 percent.

Finally, Saffer (2001) used data from the 1991 National Household Survey on Drug Abuse to examine the impact of alcohol and drug prices and control policies on self-reported involvement in several indicators of crime and violence, including arrests, property crime, property damage, use of force, and drug selling. Saffer found consistent evidence that higher beer taxes lead to significant reductions in crime, with estimates for subsamples based on age showing a relatively larger impact on crime and violence among those under age 21 than on older individuals.

The rapidly growing research on the impact of alcoholic beverage prices and control policies on violence and other crime produces generally consistent findings that increases in taxes and prices lead to significant reductions in violence.

Alcohol Prices and Educational Outcomes

A small but growing number of studies have examined the impact of alcohol taxes and prices on various measures of educational attainment. The first studies in this area used data from the National Longitudinal Survey of Youth to examine the impact on high school graduation (Yamada, Kendix, and Yamada, 1996) and on post-high school educational attainment (Cook and Moore, 1993a). Both studies concluded that higher alcoholic beverage taxes would improve educational attainment. Yamada and his colleagues, for example, estimated that a 10 percent increase in the beer tax would raise the probability of high school graduation by approximately 3 percent. Similarly, Cook and Moore predicted that, in 1982, an increase in the beer tax from 90-cents per case to $1 per case would have increased a student's probability of attending and graduating from a four-year college or university by 6.3 percent.

Two recent papers using data from the 1997 and 1999 waves of the Harvard College Alcohol Survey provide additional evidence on the impact of alcoholic beverage taxes and prices on measures of study habits and school performance among college students. Williams, Powell, and Wechsler (2002) concluded that higher beer excise taxes and policies limiting low-priced alcohol promotions (limits on happy hours and sale of beer by the pitcher) are effective in reducing alcohol use among college students and that the reductions in drinking that result lead to improvements in student grade point averages. Similarly, Powell, Williams, and Wechsler (2002) found that increases in alcohol prices (including limits on fixed-price events) would lead to improved educational outcomes by reducing the likelihood of students missing classes and/or the probability of falling behind in school as a result of their alcohol consumption.

Although some studies produce mixed findings concerning the impact of alcohol use on educational attainment (for example, Dee and Evans, 1997; Chatterji, 1998), most studies on this issue find some evidence that increased drinking during adolescence reduces schooling. Several of these studies concluded that higher alcoholic beverage taxes and prices would significantly improve school outcomes, including the probability of graduation, better study habits, and higher grade point average.

SUMMARY AND CONCLUSIONS

A large and growing body of research conducted by economists over the past two decades has examined the impact of alcoholic beverage taxes and prices on drinking prevalence, frequency, and intensity, as well as on a host of adverse outcomes related to alcohol use and abuse. The majority of these studies support the hypothesis that increases in alcoholic beverage

prices, which can be achieved by raising federal and state alcohol excise taxes as well as through a variety of other policies, are effective in reducing alcohol use. Many of these studies clearly show that these reductions in use are not limited to drinking by light or infrequent drinkers; significant reductions are also seen in heavy and/or frequent drinking and its consequences. In addition, studies that look at drinking by youth generally find even larger effects of taxes and prices than are found for the overall population, suggesting that increases in prices are particularly effective in reducing youth drinking and its consequences. Although a few studies produce contradictory findings, the overall weight of the evidence supporting the effectiveness of alcohol price increases in reducing alcohol use, abuse, and related problems is substantial.

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